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Scanning Thermal Infrared Microspectroscopy with Synchrotron Radiation

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Beamline(s): U4IR

Introduction: Scanning thermal microspectroscopy is a technique for directly sensing the absorbance of a material from its temperature rise when exposed to infrared. The local temperature change is detected using a very small platinum RTD sensor mounted on the end of an atomic force microscope (AFM) lever arm. The spatial resolution is determined not by the diffraction of light, but by the sensor probe's dimensions and the thermal properties of the specimen.

Method: An AFM lever arm equipped with a small Pt RTD sensor and IR condensing optics were installed on the U4IR interferometer. A small quantity of polystyrene was placed on the Pt RTD tip to serve as the IR absorbing medium. High-brightness infrared synchrotron radiation was brought from the U4IR spectrometer, focused onto the specimen, and spectra were collected.

Results & Conclusions: Spectra for polystyrene were successfully obtained (see figure below), showing many sharp features associated with the material's known vibrational frequencies. The spectra were not normalized to the response with no specimen present, so features due to the spectrometer's efficiency and other optical components have not been removed. The optical setup used for the experiment was designed for a large area thermal infrared source, and did not allow fine adjustments to ensure the infrared synchrotron radiation was accurately focused onto the sample. This can be easily remedied by installing the AFM/Pt RTD sensor onto the stage of an IR microspectrometer system. Such an instrument is now available at U4IR and will be used for future investigations.

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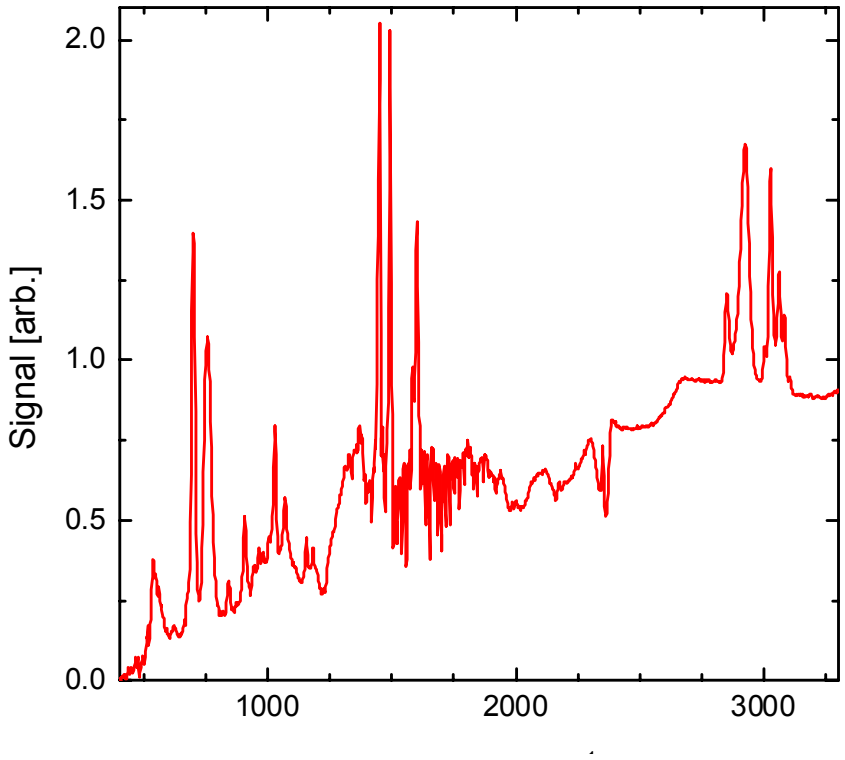

Figure 1. Thermal absorption signal from polystyrene.